

ELECTRONIC TUBE REFERENCE

12DT5

Power - Beam (NOT sweep) electronic tube

CONSOLIDATED TECHNICAL DATA
1 SECTION
CONSTRUCTION
BEAMPOWER

Beam-power tube intended for television and audio-frequency power-output applications, providing a compact output stage where moderate power and beam construction are useful.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9HN	BASE PINS	9
NOMINAL HEATER	12.6 V / 600 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

9HN - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1	–	G2 – Screen Grid	CONNECTED
PIN3	–	G1 – Control Grid	CONNECTED
PIN4	–	H – Heater	CONNECTED
PIN5	–	H – Heater	CONNECTED
PIN6	–	G1 – Control Grid	CONNECTED
PIN7	–	G3 – Suppressor Grid	CONNECTED
PIN7	–	K – Cathode	CONNECTED
PIN8	–	–	IC
PIN9	–	P – Plate (Anode)	CONNECTED

SECTION RATINGS

SECTION1 Beam Power	
TRANSCONDUCTANCE	0.0062 S
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM SCREEN VOLTAGE	250 V
MAXIMUM PLATE DISSIPATION	20 W
MAXIMUM SCREEN DISSIPATION	2 W
MAXIMUM CATHODE CURRENT	55 mA
Supplied sheet explicitly states this is the same as 6DT5 except for heater characteristics. Parent electrical table was not present in the currently available local corpus, so no unsupported promoted values were invented.	

12DT5 — Beam Power Pentode

A miniature, nine-pin beam power pentode designed for service as a vertical deflection output amplifier in television receivers with high-angle deflection systems and series-connected heater strings.

Overview

The **12DT5** is a miniature beam power pentode primarily designed for use as a vertical deflection output amplifier in television receivers employing 110-degree diagonal deflection angle picture tubes. It is optimized for operation in circuits with a B+ supply voltage of 250 volts. The tube is characterized by a high zero-bias plate current and a high ratio of plate current to grid-No. 2 (screen-grid) current, which enables it to deliver the high peak currents required for wide-angle television deflection.

To support series-string heater arrangements, the 12DT5 is engineered with controlled thermal warm-up characteristics. When used in series-connected circuits with other tubes having a nominal heater current rating of 600 mA, heater voltage surges across individual tubes are minimized. This makes the 12DT5 particularly suitable for television receivers where the picture-tube heater is wired in series with the rest of the receiver's heater string.

Heater Specifications and Series-String Operation

The 12DT5 contains an indirectly heated, coated unipotential cathode. The heater is designed for operation from either an AC or DC supply.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.60 A ± 6% (600 mA)
Calculated Heater Power	7.56 W

Heater Parameter	Value
Average Heater Warm-up Time	11 seconds

The controlled heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of its rated value after applying four times the rated heater voltage to a circuit consisting of the tube heater in series with an external resistance equal to three times the nominal heater operating resistance.

To prevent insulation breakdown between the heater and the cathode, specific heater-cathode voltage limits must be maintained:

- **Heater Negative with Respect to Cathode:** The maximum total DC and peak voltage is 200 V.
- **Heater Positive with Respect to Cathode:** The maximum DC component is 100 V, and the maximum total DC and peak voltage is 200 V.

Mechanical Design and Pinout Configuration

The 12DT5 is constructed in a miniature T-6 1/2 glass envelope with a small-button 9-pin base (JETEC E9-1). The tube conforms to the 6-3 outline and utilizes the **9HN** basing arrangement. It is designed to be mounted and operated in any position.

Physical Dimensions

- **Maximum Diameter:** 0.875 inches
- **Maximum Seated Height:** 2.375 inches
- **Maximum Overall Height:** 2.625 inches

Pin Connections (9HN Basing)

When viewed from the bottom of the tube, the nine pins provide the following connections:

- **Pin 1:** Grid No. 1 (Control Grid)
- **Pin 2:** No Connection (NC)
- **Pin 3:** Grid No. 2 (Screen Grid)
- **Pin 4:** Heater
- **Pin 5:** Heater
- **Pin 6:** Grid No. 1 (Control Grid)
- **Pin 7:** Cathode, Grid No. 3 (Suppressor Grid)
- **Pin 8:** Internal Connection (IC) — Do Not Use
- **Pin 9:** Plate

The control grid (Grid No. 1) is internally connected to both Pin 1 and Pin 6 to facilitate flexible circuit layout and heat dissipation. Grid No. 3 (the suppressor grid) is internally tied to the cathode at Pin 7. Pin 8 is designated as an internal connection and must not be used in external circuitry.

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12DT5 are measured without an external shield:

- **Grid No. 1 to Plate:** 0.57 pF
- **Input (g1 to h + k):** 12.5 pF
- **Output (p to h + k):** 4.9 pF

Typical Operating Conditions and Characteristics

The 12DT5 exhibits high transconductance and high current capability at low plate voltages, which are essential characteristics for driving magnetic deflection coils. The typical Class A1 operating points and characteristics are documented under three distinct conditions:

Parameter	Condition A (Zero Bias Knee)	Condition B (Zero Bias Knee)	Condition C (Class A1)
Plate Voltage	60 V	80 V	250 V
Grid No. 2 Voltage	150 V	250 V	250 V
Grid No. 1 Voltage	0 V	0 V	-16.5 V
Transconductance	—	—	6200 μ mos
Plate Current	95 to 100 mA	195 mA	38 to 44 mA
Grid No. 2 Current	8.5 to 15 mA	19 mA	1.5 to 2.0 mA
Grid No. 1 Cutoff Voltage (for $I_b = 100 \mu$ A)	—	—	-35 V

Note on Zero-Bias Measurements: The high plate and screen currents at zero bias (Conditions A and B) represent instantaneous knee values. These must be measured using a recurrent waveform method to ensure that the plate and screen-grid dissipation ratings are not exceeded, preventing thermal damage to the tube. When tested under static conditions, these voltages must only be applied for a short interval (a maximum of 2 seconds).

Vertical-Deflection Amplifier Service and Ratings

When operated as a vertical deflection output amplifier in a standard 525-line, 30-frame television system, the 12DT5 must be operated within its Design-Maximum ratings. These ratings represent the limiting values at which satisfactory tube life can be expected under worst-case operating conditions.

Design-Maximum Ratings

- **DC Plate Voltage:** 315 V

- **Peak Positive-Pulse Plate Voltage (Absolute Max):** 2200 V
- **Grid No. 2 (Screen-Grid) Voltage:** 285 V
- **Peak Negative-Pulse Grid No. 1 Voltage:** -250 V
- **Peak Cathode Current:** 190 mA
- **Average Cathode Current:** 55 mA
- **Plate Dissipation:** 9.0 W
- **Grid No. 2 Input:** 2.0 W

Pulse Duration Constraint

The peak positive-pulse plate voltage rating of 2200 V is an absolute maximum value. The pulse duration must not exceed 15% of a vertical scanning cycle, which corresponds to a maximum of 2.5 milliseconds in a standard vertical deflection system.

Maximum Circuit Values

- **Grid No. 1 Circuit Resistance (Fixed Bias):** 0.5 Megohm
- **Grid No. 1 Circuit Resistance (Cathode Bias):** 1.0 Megohm

In stages operating with grid leak bias, an adequate cathode bias resistor or similar protective arrangement is required to safeguard the tube against excessive current in the event that excitation is lost.

Analysis of Characteristic Curves

The average plate and grid No. 2 characteristics of the 12DT5 illustrate its performance as a beam power pentode:

- **Plate Characteristics at Screen Voltage (Ec2) of 150 V:** With the screen grid held at 150 V, the plate current curves show a sharp knee at approximately 50 V. At zero grid bias ($E_{c1} = 0$ V), the plate current rises rapidly to approximately 95–100 mA at the knee and remains relatively flat up to 500 V, demonstrating high plate resistance. As the control grid is biased more negatively (from -2 V down to -16 V), the plate current decreases in regular increments, showing good linearity.
- **Plate Characteristics at Screen Voltage (Ec2) of 250 V:** Raising the screen grid to 250 V shifts the curves upward, with the zero-bias plate current reaching a peak of 195 mA at the knee (around 80 V). This high peak current capability allows the tube to deliver the large current sweeps required for 110-degree deflection systems.
- **Grid No. 2 (Screen) Current Characteristics:** The screen current is highest at very low plate voltages (below the knee) and drops rapidly as plate voltage increases. At typical operating plate voltages (above 100 V), the screen current stabilizes at a low value (typically 1.5 to 2.0 mA at $E_b = 250$ V), which minimizes screen grid dissipation and maintains a high plate-to-screen current ratio.

Related Designations and Comparisons

The 12DT5 is part of a family of identical beam power pentodes that differ primarily in their heater configurations:

- **6DT5:** Identical to the 12DT5, but utilizes a 6.3 V, 1.2 A heater. It does not feature a controlled heater warm-up time.
- **25DT5:** Identical to the 12DT5, but utilizes a 25.0 V, 0.3 A (300 mA) heater with an 11-second controlled warm-up time, also intended for series-string applications.

These tubes share the same T-6 1/2 miniature envelope, 9HN pinout, and electrical characteristics, but they cannot be directly substituted without modifying the heater supply circuit.

Technical Summary

The **12DT5** is a miniature, 9-pin beam power pentode designed specifically for vertical deflection output service in television receivers with 110-degree deflection angles. It features a 12.6 V, 0.6 A heater with a controlled 11-second warm-up time, making it ideal for series-connected heater strings. The tube is characterized by a high peak plate current capability (up to 195 mA at zero bias), a high plate-to-screen current ratio, and a maximum plate dissipation rating of 9.0 W. Its 9HN basing configuration provides dual control-grid connections (Pins 1 and 6) and an internal suppressor-to-cathode connection. By offering robust pulse ratings and controlled thermal characteristics, the 12DT5 ensures reliable and linear vertical deflection performance in television receiver designs.



SOURCE OPERATING CONDITIONS

1950 Sylvania

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1950 SYLVANIA

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Positive Pulse Plate Voltage	2200 V	Absolute maximum
Peak Cathode Current	190 mA	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Current	44 mA	250 V plate and screen

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-Plate Capacitance	0.57 pF	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1961 Tung Sol

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1961 TUNG SOL

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Vertical-deflection output amplifier	—
Plate Voltage	60 V	LowVoltageOperatingPoint
Screen Voltage	150 V	LowVoltageOperatingPoint

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Warmup Time	11 s	—



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1965 Westinghouse Data Book

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1965 WESTINGHOUSE DATA BOOK

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage maximum	315 V	—
Peak positive pulse plate voltage maximum	2200 V	Pulse
Grid2 dissipation maximum	2 W	—
Typical grid2 voltage	150 V	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid1 cutoff voltage	-35 V	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Vertical-deflection output amplifier	—



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1966 Tung Sol Electronic Tubes 2 of 4

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Beam Power

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
A B+ SUPPLY VOLTAGE OF	250 V	A B+ SUPPLY VOLTAGE OF 250 VOLTS. IT HAS HIGH ZERO BIAS PLATE CURRENT
AND A HIGH PLATE CURRENT TO GRID #	2 mA	AND A HIGH PLATE CURRENT TO GRID #2 CURRENT RATIO. IN ADDITION, THERMAL
HEATER VOLTAGE	12.6 V	HEATER VOLTAGE 12.6 VOLTS
MAXJ MUM PEAK NEGATIVE PULSE GRID #i VOLTAGE —'	250 V	MAXJ MUM PEAK NEGATIVE PULSE GRID #i VOLTAGE —'250 VOLTS
HEATER WARM—UP TIME (APPR OX.);	11 s	HEATER WARM—UP TIME (APPR OX.); 11,Q SECONDS
HEATER VOLTAGE	12.6 V	HEATER VOLTAGE 12.6 12.6 12.6 VOLTS
PLATE VOLTAGE	60 V	PLATE VOLTAGE 60 80 .- 250 VOLTS
GRID #	2 V	GRID #2 (SCREEN) VOLTAGE 150 250 250 VOLTS
GRID #	1 V	GRID #1 VOLTAGE OE OE -16.5 VOLTS
PLATE CURRENT --	95 mA	PLATE CURRENT -- 95 195E 44 MA.
GRID #	1 V	GRID #1 CUTOFF VOLTAGE G --- --- -35 VOLTS
OF THE VOLTAGE PULSE MUST NOT F3CEED	15 V	OF THE VOLTAGE PULSE MUST NOT F3CEED 15f OF ONE SCANNING CYCLE.

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM PLATE VOLTAGE	315 V	MAXIMUM PLATE VOLTAGE 315 VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (A	6 V	MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (A 6S. MAX.) 2 ZOO VOLTS
MAXIMUM GRID #	2 V	MAXIMUM GRID #2 VOLTAGE 2B5 VOLTS
MAXIMUM PLATE DISSIPATION C	9 mA	MAXIMUM PLATE DISSIPATION C 9,0 WATTS
MAXIMUM GRID #	2 mA	MAXIMUM GRID #2 DISSIPATION '2,0 WATTS
FI%ED BIAS 'O	5 MΩ	FI%ED BIAS 'O.5 MEGOHM
CATHODE BIAS	1 MΩ	CATHODE BIAS 1.0 MEGOHM



1971 RCA HB3 Binder 5 of 7

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1971 RCA HB3 BINDER 5 OF 7

Section 1 · Beam Power

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Voltage (AC or DC)	12.6 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Current – published value 1	600 mA	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Current – published value 2	6 A	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Warm-up time (Average)	11	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Heater voltage	12.6 V	Nominal heater rating
Heater current	600 mA	Nominal heater rating



SOURCE DATA APPENDIX

1975 RCA RC30

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1975 RCA RC30

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage (ac/dc) 6.3	12.6 V	Published in approved 12DT5 target entry; Section1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Current 1.2	600 mA	Published in approved 12DT5 target entry; Section1
Heater Warm-up Time (Average)	11 seconds	Published in approved 12DT5 target entry; Section1
of	100 mA	Published in approved 12DT5 target entry; Section1
of 100 mA – –	-35 V	Published in approved 12DT5 target entry; Section1
DC Plate Voltage	315 V	Published in approved 12DT5 target entry; Section1
Grid-No.2 (Screen-Grid) Voltage	285 V	Published in approved 12DT5 target entry; Section1
Peak Negative-Pulse Grid-No.1 (Control-Grid) Voltage	250 V	Published in approved 12DT5 target entry; Section1
Peak Cathode Current	190 mA	Published in approved 12DT5 target entry; Section1
Average Cathode Current	55 mA	Published in approved 12DT5 target entry; Section1
Grid-No.2 Input	2 W	Published in approved 12DT5 target entry; Section1
For fixed-bias operation	0.5 MΩ	Published in approved 12DT5 target entry; Section1
For cathode-bias operation	1 MΩ	Published in approved 12DT5 target entry; Section1
Heater Voltage (ac/dc) 3.16 4.2	6.3 V	Published in approved 12DT5 target entry; Section1
Heater Current 0.6 0.45	300 mA	Published in approved 12DT5 target entry; Section1
Plate Voltage	330 V	Published in approved 12DT5 target entry; Section1
Grid-No.3 Voltage	28 V	Published in approved 12DT5 target entry; Section1
Grid-No.2 Supply Voltage	330 V	Published in approved 12DT5 target entry; Section1
Grid-No.1 (Control-Grid) Voltage, Positive-bias value	0 V	Published in approved 12DT5 target entry; Section1
Plate Dissipation	1.7 W	Published in approved 12DT5 target entry; Section1
For grid-No.2 voltages up to	165 V	Published in approved 12DT5 target entry; Section1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
For grid-No.2 voltages up to 165 volts	1.1 W	Published in approved 12DT5 target entry; Section1
For grid-No.2 voltages between 165 and	330 V	Published in approved 12DT5 target entry; Section1
For fixed-bias operation	0.25 MΩ	Published in approved 12DT5 target entry; Section1
For cathode-bias operation	0.5 MΩ	Published in approved 12DT5 target entry; Section1

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage 60 80	250 V	Published in approved 12DT5 target entry; Section1
0	16.5 V	Published in approved 12DT5 target entry; Section1
Transconductance	6200 μS	Published in approved 12DT5 target entry; Section1
Plate Current 95* 195«	44 mA	Published in approved 12DT5 target entry; Section1
Grid-No.2 Current 8.5> 19*	1.5 mA	Published in approved 12DT5 target entry; Section1
Plate Supply Voltage	160 V	Published in approved 12DT5 target entry; Section1
Grid-No.2 (Screen-Grid) Supply Voltage	100 V	Published in approved 12DT5 target entry; Section1
Cathode-Bias Resistor	560 Ω	Published in approved 12DT5 target entry; Section1
Plate Resistance (Approx.)	0.15 MΩ	Published in approved 12DT5 target entry; Section1
Transconductance, Grid No.1 to Plate	1350 μS	Published in approved 12DT5 target entry; Section1
Grid-No.2 Current	1.8 mA	Published in approved 12DT5 target entry; Section1
Grid-No.1 Voltage (Approx.) for plate current of 10 tiA	-5.2 V	Published in approved 12DT5 target entry; Section1
Grid-No.3 Voltage (Approx.) for plate current of 10 fiA	-4.2 V	Published in approved 12DT5 target entry; Section1

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid No.1 to Plate	0.02 pF	Published in approved 12DT5 target entry; Section1
Internal Shield	5.8 pF	Published in approved 12DT5 target entry; Section1
Grid No.3 to Plate	1.7 pF	Published in approved 12DT5 target entry; Section1
Grid No.1 to Grid No.3	0.1 pF	Published in approved 12DT5 target entry; Section1
Internal Shield	6.1 pF	Published in approved 12DT5 target entry; Section1

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